IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appellants:	Kaus et al.	Docket Number:	DE020307
Serial Number:	10/537,883	Examiner:	Nguyen, Phu K.
Filing Date:	June 7, 2005	Art Unit:	2628
Title:	Method of segmenting a three-dimensional data set allowing user corrections		

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Appeal Brief

This Appeal Brief follows a final Office action mailed from the U.S. Patent and Trademark Office on June 19, 2007, an Advisory action mailed August 29, 2007 and Appellant's Notice of Appeal submitted on September 14, 2007.

Appellants believe that a fee in the amount of $510.00 is due under 37 C.F.R. §41.20(b)(2).

1. Real party in interest

Koninklijke Philips Electronics N.V. is the real party in interest in this case.

2. Related appeals and interferences

No prior or pending appeals, interferences, or judicial proceedings are known to Appellants, Appellants' legal representative, or Assignee which may directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal in the above-referenced case.

3. Status of claims

The Office action of June 19, 2007 rejected claims 1-5 under 35 U.S.C. § 103(a) in view of Cohen et al. (Finite Element Methods for Active Contour Models and Balloons for 2D and 3D images) in combination with Appellants' admitted prior art, ¶[0007] of the specification as published, page 2 lines 21-27 as originally filed, and rejected claim 5 under 35 U.S.C. § 101. Claims 1-5 are pending and are here appealed. The Advisory action mailed August 29, 2007 maintained these rejections.

4. Status of amendments

The amendments to the claims in Appellants' Amendment and Response mailed July 30, 2007 were not entered by the examiner. Therefore the claims pending are those submitted in Appellants' Amendment and Response dated March 27, 2007.

5. Summary of claimed subject matter

Claim 1 is directed to a method of segmenting a three-dimensional structure from a three-dimensional, and in particular medical, data set while making allowance for user corrections. The method includes the steps of: providing a three-dimensional deformable model (M) whose surface is formed by a network of mashes that connect nodes at the surface of the model; positioning the model (M) at a point in a three-dimensional data set at which the structure to be segmented is situated; manual displacement of nodes; and re-calculation of the nodes of the model (M) in weighted consideration of the nodes that have been displaced manually.

6. Grounds of rejection to be reviewed on appeal

6.1 Rejection of claims 1-5 under 35 U.S.C. § 103(a)

Independent claim 1 and dependent claims 2-5 stand rejected under 35 U.S.C. §103(a) in view of ¶[0007] of Appellants' specification as published, p. 2 lines 21-27 as originally filed, in combination with Cohen et al. (Finite Element Methods for Active Contour Models and Balloons for 2D and 3D images, published November 5, 1991).

6.2 Rejection of claim 5 under 35 U.S.C. § 101

Dependent claim 5 stands rejected under 35 U.S.C. § 101.

7. Argument

7.1 Introduction: history of prosecution

The application as filed contained claims 1-5. Claims 1-5 were rejected under 35 U.S.C. § 103(a) in view of Cohen et al. (Finite Element Methods for Active Contour Models and Balloons for 2D and 3D images) in combination with ¶[0007] in an Office action mailed December 27, 2006. Claim 5 was rejected also under 35 U.S.C. § 101 and 35 U.S.C. § 112 ¶1 in this Office action. Appellants amended claim 5 and traversed rejection of claims 1-5 in an Amendment and Response submitted March 27, 2007.

Rejection of claim 5 under 35 U.S.C. § 112 ¶1 was withdrawn in a final Office action mailed June 19, 2007.

Rejection of claims 1-5 under 35 U.S.C. § 103(a) in view of Cohen et al. (Finite Element Methods for Active Contour Models and Balloons for 2D and 3D images) in combination with ¶[0007] of the specification was maintained in the final Office action mailed June 19, 2007, as was rejection of claim 5 under 35 U.S.C. § 101. Appellants amended claims 1 and 5 and traversed rejections in an Amendment and Response filed July 31, 2007.

Rejection of claims 1-5 under 35 U.S.C. § 103(a) in view of Cohen et al. in combination with ¶[0007] was maintained in the Advisory action mailed August 29, 2007, as was rejection of claim 5 under 35 U.S.C. § 101, and amendments to claims 1 and 5 were not. Appellants submitted a Notice of Appeal on September 14, 2007.

7.2 35 U.S.C. §103(a)

7.2.1 Characterization of cited prior art

The Office action mailed June 19, 2007 on page 2 rejects claims 1-5 under 35 U.S.C. §103(a) in view of ¶[0007] of Appellants specification as published, page 2 lines 21-27 as originally filed, in combination with Cohen et al. (Finite Element Methods for Active Contour Models and Balloons for 2D and 3D images) published November 5, 1991.

The subject matter of the present independent claim 1 is summarized in Section 5 above.

7.2.2 Characterization of prior art references

As a preliminary matter, the Supreme Court in *Graham v. John Deere*, 383 U.S. 1, provided an analytical construct to be used when determining whether claims are obvious under 335 U.S.C §103(a) in view of prior art. One aspect of this analytical construct includes first characterizing each of the prior art references, as background for legal analysis of the combination of the cited references which is here found in Section 7.3.3.

Appellants' specification ¶[0007] as published

The specification ¶[0007] shows a method that includes steps of deforming a matched-up model manually (e.g. by displacing a node) after automatic segmentation has taken place. The automatic segmentation is then performed a second time with the deformed model.

For convenience of the reader, ¶[0007] is shown below in entirety:

> Another known method of the generic kind comprises, after automatic segmentation has taken place, deforming the matched-up model manually, e.g. by displacing a node. The automatic segmentation is then performed for a second time with this deformed model. What is problematic about this method is that the step of the method in which the internal and external energies are minimized moves the nodes that have been displaced manually back to their original positions, because it is at these positions that the energy of the deformable model is at a minimum. [emphases added]

Factual analysis demonstrates that ¶[0007] shows manually distorting a model by displacing nodes. Further, ¶[0007] shows automatic segmentation of a model.

Nowhere does ¶[0007] teach or suggest recalculation of the nodes of a model in weighted consideration of the nodes that have been displaced manually, to which claim 1 as originally filed is directed. In contrast, ¶[0007] merely shows manually displaced nodes moved back to their original positions during a second automatic segmentation.

In fact, the Office action on page 3 admits that "the Prior Art does not teach re-calculation of the nodes of the model (M) in weighted consideration of the nodes that have been displaced manually." [emphasis added]

For these reasons, ¶[0007] alone does not render claim 1 obvious. Claims 2-5 depend directly or indirectly on claim 1 and incorporate all the subject matter of claim 1 and contain additional subject matter. As claim 1 is not obvious for the above reasons, therefore these claims also are not obvious in view of ¶[0007] alone.

Appellants now show that Cohen, the other cited reference, does not cure the defects of ¶[0007].

Cohen et al., Finite Element Methods for Active Contour Models and Balloons for 2D and 3D images, published November 5, 1991

Cohen shows a 3D generalization of a balloon model as a 3D deformable surface (Cohen et al., Abstract). The surface is deformed under the action of internal and external forces attracting the surface toward detected edgels by an attraction potential (Ibid., Abstract).

Cohen shows incorporating a "weight force" into his 3D reconstruction modes (Ibid., Section 2.2.2). The weight force allows Cohen to take a simple initial surface placed on the border of the image and have the surface fall under the influence of the "gravity" to catch an object that might be far from the border (Ibid., Section 2.2.2). Cohen shows simulating gravity in applying the weight force by applying the force uniformly on the surface, viz., uniformly in direction and uniformly in intensity (Ibid., Section 2.2.2). Further, Cohen shows a 3D image that is isotropic (Ibid., Section 4.4). Cohen states; "Setting $w_{10}=w_{01}$ and $w_{20}=w_{11}=w_{02}$ presupposes that the 3D image is isotropic and thus that all directions have equal weight." (Ibid., Section 4.4; emphases added).

Nowhere does Cohen teach or suggest manual displacement of nodes, to which claim 1 is directed. Nowhere does Cohen teach or suggest recalculation of the nodes of the model in weighted consideration of the nodes that have been displaced manually. In fact, Cohen teaches away from weighted consideration of the nodes that have been manually displaced as Cohen shows weighting nodes equally (Ibid., Section 2.2.2), i.e. Cohen teaches that all nodes are weighted equally, which is really the same as no weighted consideration of nodes at all

The Office action on p. 3 cites Cohen Section 4.4, alleging that this section teaches re-calculation of nodes in weighted consideration of the nodes.

Appellants respectfully disagree. Cohen section 4.4 shows, teaches and suggests only setting coefficients for edge detection and surface smoothing, not allowing user correction of an image. Cohen chooses elasticity and rigidity coefficients such that the internal forces have the same magnitude as the external forces and the resulting solution surface fits the edge points while being smooth and regular (Ibid., Section 4.4).

Nowhere does this section teach or suggest recalculation of the nodes of a model in weighted consideration of the nodes that had been displaced manually, to which claim 1 is directed.

In contrast to the allegation in the Office action, Cohen clearly states "[s]etting $w_{10}=w_{01}$ and $w_{20}=w_{11}=w_{02}$ presupposes that the 3D image is isotropic and thus that all directions have equal weight." (Ibid., Section 4.4; emphases added). Isotropic is defined in the Merriam Webster online dictionary as "exhibiting properties (as velocity of light transmission) with the same values when measured along axes in all directions" [emphases added]. See Appendix A of the Amendment and Response submitted July 31, 2007, which is a print-out from the on-line dictionary showing this definition of "isotropic". This Response was entered into the record.

Further, Cohen shows that he intends the "weight" he uses to be applied equally to all points like the force of gravity. For example, Cohen et al. in section 1.2.2 clearly states:

> ...separately we make use of a 'weight' force which simulates gravity...The philosophy of the approach is to introduce an elastic curve (or surface) in the image, and let it evolve from an initial position under the action of both internal forces (smoothness constraints and pressure forces) and external forces (attraction toward local edgels and weight forces).

This factual analysis demonstrates that, in contrast to "weighted consideration of the node", Cohen shows all directions having equal weights.

For these reasons, Cohen alone fails to render claim 1 obvious, and fails to cure the defects of ¶[0007] with respect to claim 1.

As Cohen fails to cure the defects of the other reference cited in combination, Appellants' specification ¶[0007], therefore claim 1 is not obvious in view of ¶[0007] in combination with Cohen. Claims 2-5 depend directly or indirectly on claim 1 and incorporate all the subject matter of claim 1 and contain additional subject matter. As claim 1 is not obvious for the above reasons, therefore these claims also are not obvious in view of ¶[0007] in combination with Cohen.

7.2.3 Legal analysis

According to a summary of criteria for evaluating claims under 35 U.S.C. §103(a) in the *Manual of Patent Examining Procedure*,

> To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *Manual of Patent Examining Procedure (M.P.E.P.)* §2142 (8th Ed. Rev.3, August, 2005); *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991), [emphasis added].

A recent decision by the U.S. Supreme Court, *KSR International Co. v. Teleflex Inc.* 550 U.S.___, (2007), discusses criteria for showing a motivation to combine numerous prior art references in a determination that a claimed invention is obvious. The U.S. Supreme Court in *KSR* explained that "[t]here is no necessary inconsistency between the idea underlying the TSM [teaching, success, motivation] test and the *Graham* analysis." *KSR international Co.* 550 U.S.____ at p. 15. In fact, the court explains "... it can be important to identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the newly claimed invention does." Ibid.

This interpretation of *KSR International Co. v. Teleflex Inc.* is confirmed by Guidelines promulgated by the U.S. Patent and Trademark Office and published October 10, 2007 in the Federal Register (vol. 72, no. 195, pp. 57526-57535).

Appellants respectfully traverse the above rejection, and show that the facts of the case and the relevant case law indicate that the invention would not have been obvious to one of ordinary skill in the art at the time the application was filed because the underlying facts show that the criteria for a *prima facie* rejection have not been met.

Failure of the cited prior art to teach or suggest all the claim limitations

To establish a *prima facie* case for obviousness of a claimed invention, all of the claim limitations must be taught or suggested by the prior art. *M.P.E.P.* §2143.03; *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974).

Claim 1 is directed *inter alia* to re-calculation of the nodes of the model in weighted consideration of the nodes that have been displaced manually.

The Office action on page 3 admits in reference to ¶[0007] that "the Prior Art does not teach re-calculation of the nodes of the model (M) in weighted consideration of the nodes that have been displaced manually." [emphasis added]

The above factual analysis demonstrates that Cohen also does not teach or suggest re-calculation of the nodes of the model in weighted consideration of the nodes that have been displaced manually. In fact, Cohen clearly shows, teaches and suggests only equal weighting.

Therefore, by consideration of the legal criteria discussed above, the underlying facts of the content of the cited prior art, and of the present pending claims, the prior art fails to teach or suggest all of the subject matter of the claims of the present invention. Therefore, a *prima facie* case that claim 1 of the present invention is obvious has not been made.

Claims 2-5 depend directly on claim 1 and incorporate all of the subject matter of this claim and contain additional subject matter. Therefore these claims also are not obvious in view of ¶[0007] and Cohen, alone or in combination.

Proposed modification changes the principle of operation of Appellants' invention

The *M.P.E.P.* states "[I]f the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious." *M.P.E.P.*, §2143.01, p. 138.

In *In re Ratti*, 270 F.2d 810 (CCPA 1959), claims were directed to an oil seal having a bore engaging portion with outwardly biased resilient spring fingers inserted in a resilient sealing member. See *M.P.E.P.* §2143.01. The primary reference relied upon in a rejection based on a combination of references showed an oil seal in which the bore engaging portion was reinforced by a cylindrical sheet metal casing. See *M.P.E.P.* §2143.01. The prior art device required rigidity for operation, whereas the claimed invention required resiliency. See *M.P.E.P.* §2143.01. The court reversed the rejection holding that the "suggested combination of references would require a substantial reconstruction and redesign of the elements shown in [the primary reference] as well as a change in the basic principle under which the [primary reference] construction was designed to operate." See *M.P.E.P.* §2143.01 citing *In re Ratti* 270 F.2d at 813.

Combining ¶[0007] with Cohen at the time the present application was filed would have required changing the principle of operation in Cohen by requiring Cohen to have weighted individual nodes, rather than all nodes equally in a simulation of gravity. The generic method described in ¶[0007], of distorting the model with manual changes, operates differently than Cohen's applying a uniform force to all points on a surface as a simulation of gravity.

Cohen shows the use of iterative algorithms to perform tasks such as edge detection. Direct user correction of the model would have been a change to Cohen's principle of operation, in that instead of an algorithm, direct user intervention would have defined the distortion of the image.

For any of these changes in principles of operation, there would have been no motivation to have combined the method described in ¶[0007] with the method in Cohen, at the time the present application was filed, as such a combination would have required a complete reconstruction and change in the basic principles of operation of the device in Cohen (See *M.P.E.P.* §2143.01 citing *In re Ratti*, 270 F.2d 810). Therefore, a *prima facie* case that claim 1 of the present invention is obvious has not been made.

Claims 2-5 that depend directly or indirectly from claim 1 and incorporate all of the subject matter of claim 1 and contain additional subject matter, also are not obvious in light of the cited references for these reasons.

Appellants respectfully request that rejection of claims 1-5 under 35 U.S.C. §103(a) be withdrawn.

7.3 35 U.S.C. §101

The Office action mailed June 19, 2007 on pages 3-6 rejects claim 5 under 35 U.S.C. § 101.

Claim 5 is directed to a computer program for a control unit for controlling a memory unit, an image-reproduction unit, a calculating unit and a positioning unit of an image-processing arrangement, wherein the program is embedded in a computer readable medium, for controlling the image-processing arrangement as claimed in Claim 4 according to the following steps: provision of a three-dimensional deformable model whose surface is formed by a network of mashes that connect nodes at the surface of the model; positioning of a model at a point in a three-dimensional data set at which the structure to be segmented is situated; manual

displacement of nodes; and re-calculation of the nodes of the model (M) in weighted consideration of the nodes that have been displaced manually.

Legal analysis

The *M.P.E.P.* states that a claimed process is clearly statutory subject matter under 35 U.S.C. § 101 if it results in a physical transformation outside the computer, i.e. falls into one or both of the following specific categories ("safe harbors"): independent physical acts and manipulation of data representing physical objects or activities. *M.P.E.P.* §2106 p. 15, 16. As an example of a statutory process that shows manipulation of data representing physical objects or activities, the *M.P.E.P.* cites the following:

> -A method of using a computer process to receive data representing Computerized Axial Tomography ("CAT") scan images of a patient, performing a calculation to determine the difference between a local value at a data point and an average value of the data in a region surrounding the point, and displaying the difference as a gray scale for each point in the image, and displaying the resulting image. Ibid., p. 16.

The Office action on p. 5 alleges that the invention claimed in Claim 5 is not supported by either a positively asserted utility or a well established utility.

Claim 5 is directed to a computer program that recalculates the nodes of a 3D model in weighted consideration of the nodes that have been displaced manually for controlling the arrangement as claimed in claim 4. Claim 4 depends from claim 1, which is directed to, *inter alia,* a medical data set. See claim 1, line 2. The claimed invention is analogous to the above example from the M.P.E.P. in that it is directed to enhancing imaging data of tissue by recalculating a 3D model of that tissue in weighted consideration of user corrections. The claimed invention produces a useful, tangible and concrete result for the following reasons.

The computer program of claim 5 produces the tangible result of modifying a 3D model in accordance with user input. The program is embedded in a computer readable medium and the 3D model is viewed as recalculated by the program. Recalculation of the nodes of the 3D model transforms the existing 3D model into a new model that more clearly defines the medical data set, for example, the structures of the tissue.

The Office action alleges on p. 6,

> The claimed 'computer program' per se is not a process or practical application since it is not concretely written into a memory, nor run by a computer to form a process. In contrast, a claimed computer readable medium encoded

> with a computer program, executed by a computer, is a computer element which defines structural and functional interrelationships between the computer program and the rest of the computer which permit the computer program functionality to be realized, and is thus statutory.

In contrast to this allegation, a search of the USPTO Patent Full-Text and Image Database search for the combination of terms: "program and embedded and computer and readable and medium" returned 1288 hits among issued patents. Appellants show below that the first three in the list of issued patents returned from the search have claims with language nearly identical to that in present claim 5, i.e. "...wherein the program is embedded in a computer readable medium..."

Claim 7 of U.S. patent number 7287284 states, "A ***computer program***, embodied in a ***computer-readable medium...***" (bold and italics as returned by USPTO search engine).

Claim 21 of U.S. patent number 7287094 states, "A ***computer program*** product used in conjunction with a ***computer*** system, the ***computer program*** product comprising a ***computer readable*** storage ***medium and a computer program*** mechanism ***embedded*** therein..." (bold and italics as returned by USPTO search engine).

Claim 34 of U.S. patent number 7287057 states, "A ***computer readable*** storage ***medium embedded computer*** instructions for transmitting messages from a plurality of client messaging applications to an autonomous ***computer program*** that acts as an agent for another ***program...***" (bold and italics as returned by USPTO search engine).

The above analysis shows that the subject matter of present claim 5 produces a useful, tangible and concrete result. Further, the language of claim 5 is nearly identical to that of claims in numerous recently issued United States patents. Therefore, Appellants assert that claim 5 complies with 35 U.S.C. § 101.

Appellants respectfully request that rejection of claim 5 under 35 U.S.C. § 101 be withdrawn.

Respectfully submitted,

Sonia K. Guterman, Reg. No. 44,729
Adam M. Schoen, Reg. No. 58,576
Attorneys for Appellants
Lawson & Weitzen, LLP
88 Black Falcon Ave., Suite 345
Boston, Massachusetts 02110-2481
Tel: (617) 439-4990
Fax: (617) 439-3987

Date: November 1, 2007

8. Claims appendix

1. (original) A method of segmenting a three-dimensional structure from a three-dimensional, and in particular medical, data set while making allowance for user corrections, having the following steps:

a) provision of a three-dimensional deformable model (M) whose surface is formed by a network of mashes that connect nodes at the surface of the model,

b) positioning of the model (M) at a point in a three-dimensional data set at which the structure (6) to be segmented is situated,

c) manual displacement of nodes,

d) re-calculation of the nodes of the model (M) in weighted consideration of the nodes that have been displaced manually.

2. (original) A method as claimed in claim 1, wherein step d) comprises the following steps:

determination of a candidate point for each sub-surface defined by mashes of the model, each candidate point being situated on a normal to the sub-surface,

assignment of a weighting factor to each node that has been displaced, the weighting factor being larger the smaller distance between the displaced node and a boundary surface of the structure to be segmented,

re-calculation of the nodes of the model while allowing for the candidate points determined, the displaced nodes, and the weighting factors assigned.

3. (original) A method as claimed in claim 1, characterized in that step d) the nodes are re-calculated by minimizing a weighted sum of external energy, internal energy and an energy that takes into account the manually displaced nodes.

4. (original) An image-processing arrangement for performing the method claimed in claim 1, comprising:

a memory unit for storing a deformable model whose surface is formed by a network of meshes that connect the nodes at the surface of the model, and for storing a three-dimensional data set and in particular a medical data set,

an image-reproduction unit for reproducing a structure to be segmented and the deformable model,

a calculating unit for re-calculating the nodes of the model in weighted consideration of nodes which have been displaced manually,

a positioning unit for positioning the model at the point in the three-dimensional data set at which the structure to be segmented is situated,

a control unit for controlling the memory unit, the image-reproduction unit, the calculating unit and the positioning unit to perform the following steps:

a) provision of a three-dimensional deformable model (M) whose surface is formed by a network of meshes that connect nodes at the surface of the model,

b) positioning of the model (M) at a point in a three-dimensional data set at which the structure (6) to be segmented is situated,

c) manual displacement of nodes,

d) re-calculation of the nodes of the model (M) in weighted consideration of the nodes that have been displaced manually.

5. (previously presented) A computer program for a control unit for controlling a memory unit, an image-reproduction unit, a calculating unit and a positioning unit of an image-processing arrangement, wherein the program is embedded in a computer-readable medium, for

controlling the image-processing arrangement as claimed in Claim 4 according to the following steps:

a) provision of a three-dimensional deformable model (M) whose surface is formed by a network of mashes that connect nodes at the surface of the model,

b) positioning of the model (M) at a point in a three-dimensional data set at which the structure (6) to be segmented is situated,

c) manual displacement of nodes,

d) re-calculation of the nodes of the model (M) in weighted consideration of the nodes that have been displaced manually.

9. Evidence appendix

No evidence is submitted pursuant to 37 C.F.R. §§1.130, 1.131, or 1.132.

10. Related proceedings appendix

There are no proceedings related to this appeal.